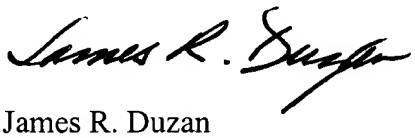
REMARKS

This amendment corrects errors in the text. Entry is respectfully solicited.

This amendment is submitted prior to or concurrently with the payment of the issue fee and, therefore, no petition or fee is required. No new matter has been added.

Respectfully submitted,



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IN THE SPECIFICATION:

Please replace paragraph number **[0001]** with the following rewritten paragraph:

[0001] ~~Cross-Reference~~Cross-Reference to Related Applications: This application is a continuation of application Serial No. 09/302,083, filed April 29, 1999, now U.S. Patent ~~6,277,673 B1~~ 6,277,673, issued August 21, 2001, which is a continuation of application Serial No. 08/774,609, filed December 30, 1996, now U.S. Patent 5,907,769, issued May 25, 1999.

Please replace paragraph number **[0003]** with the following rewritten paragraph:

[0003] State of the Art: High performance, low cost, increased miniaturization of components, and greater packaging density of integrated circuits have been and are goals in the electronics industry. Greater integrated circuit package ~~density,~~ density for a given level of component and internal conductor ~~density,~~ density is primarily limited by the space available for semiconductor device mounting and packaging. For lead frame mounted semiconductor devices, this limitation is a result of the conventional lead frame design, such conventional lead frame design inherently limits potential single-die package density because the die-attach paddle of the lead frame must be as large or larger than the semiconductor device secured thereto. The larger the semiconductor device, the less space (relative to size of the semiconductor device) that remains around the periphery of the die-attach paddle for bond pads for attendant wire bonding. Furthermore, the inner ends of the lead fingers of a lead frame provide anchor points for the lead fingers when the lead fingers and the die are encapsulated in plastic. These anchor points may be emphasized later as flanges or bends or kinks in the lead. Therefore, as the die size is increased in relation to the package size in ever decreasing size semiconductor packages, there is a corresponding reduction in the space along the sides of the package for the encapsulating plastic which joins the top and bottom portions of the molded plastic body at the mold part line and anchors to the leads. As the leads are subjected to the normal stresses of forming and assembly operations, the encapsulating plastic may crack, which may destroy the package seal and substantially increase the probability of premature semiconductor device failure.

Please replace paragraph number **[0004]** with the following rewritten paragraph:

[0004] One method of increasing integrated circuit density is to stack semiconductor dice vertically. United States Patent 5,012,323 to Farnworth illustrates combining a pair of semiconductor devices mounted on opposing sides of a lead frame. An upper semiconductor device is back-bonded to the upper surface of the leads of the lead frame by a first adhesively coated, insulated film layer. The lower semiconductor device is face-bonded to the lower lead frame die-bonding region via a second, adhesively coated, insulative, film layer. The wire-bonding pads on both upper and lower semiconductor devices are interconnected with the ends of their associated lead extensions with gold or aluminum wires. The lower device needs to be ~~sightly~~ slightly larger than the upper device in order that the lower die bonding pads are accessible from above through an aperture in the lead frame such that gold wire connections can be made to the lead extensions. However, this arrangement has a major disadvantage from a production standpoint, since the different size semiconductor devices require that different separate equipment produce the different dice or that the same equipment be switched over in different production runs to produce the different semiconductor devices. Moreover, the lead frame design employed by Farnworth employs long conductor runs between the die and the exterior of the package. Also, the lead frame configuration is specialized and rather complex.

Please replace paragraph number **[0005]** with the following rewritten paragraph:

[0005] United States Patent 5,291,061 to Ball illustrates a multiple stacked semiconductor device that contains up to four such devices which does not exceed the height of current single semiconductor device packages. The low profile of the semiconductor device is achieved by close-tolerance ~~stacking~~ stacking, which is made possible by a low-loop-profile wirebonding operation and thin adhesive layers between the stacked semiconductor devices. However, Ball secures all of the semiconductor devices to the same side of the lead frame, thereby increasing wire length. Moreover, Ball employs a die paddle to support the semiconductor device stack.

Please replace paragraph number **[0018]** with the following rewritten paragraph:

[0018] As illustrated, the semiconductor device 100 includes a plurality of bond pads 102 located on the longer peripheral sides 104 thereon, rather than on the ends 106 of the semiconductor device 100. The semiconductor device 100 may be of any type, such as a memory device, a microprocessor, etc. The lead frame 10 of the present invention is illustrated having a first plurality of lead fingers ~~12 which~~ 12, which at one time were connected to tie bars 14 before being separated therefrom during the packaging process of the semiconductor device 100. The first plurality of lead fingers 12 extends substantially inwardly in a substantially parallel manner with respect to adjacent individual lead fingers 12 from the tie bars 14 to terminate at ends 13 ~~thereof~~ thereof, which are located substantially adjacent the longer peripheral sides 104 of the semiconductor device 100 in substantially the same horizontal plane as the active surface 108 of the semiconductor device 100.

Please replace paragraph number **[0019]** with the following rewritten paragraph:

[0019] As further illustrated, the lead frame 10 of the present invention further includes a second plurality of lead fingers 18, each lead finger 18 extending substantially inwardly in a substantially parallel manner with respect to individual adjacent lead fingers 18 from the tie bars 14 and is downset at portions 20 thereon to have portions 22 thereof lying in a horizontal ~~plane~~ plane, which is substantially slightly lower than the bottom inactive surface of the semiconductor device 100, the portions 22 of each lead finger 18 having a first portion which extends substantially parallel to the end 106 of the semiconductor device 100 and a second portion which extends substantially perpendicular to the end 106 of the semiconductor device 100 and extending thereto, and lead finger portions 24 which extend under the bottom inactive surface of the semiconductor device 100, which help support the semiconductor device 100, and terminate at ends 26 outside the semiconductor device 100 substantially adjacent a longer peripheral side 104 of the semiconductor device 100. Each lead finger portion 24 of a lead finger 18 has a first portion extending substantially parallel to a longer peripheral side 104 of the semiconductor device 100 and a second portion terminating in an end 26 extending

substantially perpendicular to the longer peripheral side 104 of the semiconductor device 100 and a third transition portion which may contain one or more angled portions therein to transition the lead finger 18 from extending in a first direction from perpendicular to an end 106 of the semiconductor device 100 to perpendicular to a longer peripheral side 104 of the semiconductor device 100.

Please replace paragraph number **[0020]** with the following rewritten paragraph:

[0020] The lead frame 10 of the present invention further includes die paddle 28 formed by die paddle members 30 in any desired geometric shape, having an opening therein or formed as a unitary piece, which are, in turn, connected to die paddle supports 32, each of which contain downsets 34 ~~therein~~ therein, so that the die paddle 28 is located in a horizontal plane below the semiconductor device 100. The die paddle supports 32 each further include ends 36 ~~thereon~~ thereon, which terminate outside the semiconductor device 100 substantially adjacent a longer peripheral side 104 of the semiconductor device 100. Outer portions 38 of the die paddle supports 32 extended to frame rails 16 of the lead frame 10 before being severed therefrom after packaging of the semiconductor device 100.

Please replace paragraph number **[0023]** with the following rewritten paragraph:

[0023] As illustrated, a piece of suitable tape 40, such as Kapton tape, is adhesively secured, using any suitable thermo-setting adhesive, to the lead finger portions 24 of the first plurality of lead fingers 18, the die paddle members 30, and die paddle supports 32. Preferably, a silver filled epoxy paste adhesive material is used to adhesively attach the semiconductor device 100 to the tape 40.

Please replace paragraph number **[0024]** with the following rewritten paragraph:

[0024] Referring to drawing Fig. 2, the semiconductor device 100 is adhesively attached to tape 40 which is, in turn, adhesively attached using a suitable thermosetting adhesive to the die paddle supports 32 and lead finger portions 24 of the second plurality of lead

fingers 18. As illustrated, the ends 13 of the first plurality of lead fingers 12 and ends 36 of the second plurality of lead fingers 18 are connected to the bond pads 102 of the active surface 108 of the semiconductor device 100 by wire bonds 50.

Please replace paragraph number **[0025]** with the following rewritten paragraph:

[0025] Since the first plurality of lead fingers 12 is located in substantially the same horizontal plane 600 as the active surface 108 of the semiconductor device 100 having bond pads 102 thereon and the second plurality of lead fingers 18 is located in substantially the same horizontal plane 500 below the inactive bottom surface of the semiconductor device 100, a large number of lead fingers 12 and 18 may be used to form connections between the bond pads 102 and the first plurality of lead fingers 12 and second plurality of lead fingers 18 because the lead fingers 12 and 18 are located in different horizontal planes with respect to the semiconductor device 100. Furthermore, the second plurality of lead fingers 18 may be used to support the semiconductor device 100 in the package 200 and may be used to conduct heat away from the semiconductor device 200 during operation. In this manner, greater flexibility is created in the design of the circuitry of the semiconductor device 100 and the location of the bond pads 102 thereon. Additionally, since the lead frame 10 of the present invention has the location of the first plurality of lead fingers 12 adjacent the longer peripheral sides 104 of the semiconductor device 100 in substantially the same horizontal plane as the active surface 108 of the semiconductor device 100 while the second plurality of lead fingers 18 is located in substantially the same horizontal plane as the die paddle members 30 supporting the semiconductor device 100, the assembly of the semiconductor device 100 and lead frame 10 of the present invention may be wire bonded in conventional wire bonding equipment and encapsulated in conventional die molding equipment without substantial modification thereof. In this manner, the present invention of the lead frame 10 and semiconductor device 100 saves the expenditure of capital investment in new wire bonding and die molding equipment.

Please replace paragraph number **[0028]** with the following rewritten paragraph:

[0028] The lead frame 10′ of the present invention is illustrated having a first plurality of lead fingers 12′ extending substantially inwardly, terminating at ends 13′ ~~thereof~~ thereof, which are located substantially adjacent the longer peripheral sides 104′ of the semiconductor device 100′ in substantially the same horizontal plane as the active surface 108′ of the semiconductor device 100′.

Please replace paragraph number **[0029]** with the following rewritten paragraph:

[0029] As further illustrated, the lead frame 10′ of the present invention further includes a second plurality of lead fingers ~~18′ which~~ 18′, which extends substantially inwardly and is downset at portions 20′ thereon to have portions 22′ thereof lying in a horizontal ~~plane~~ plane, which is substantially slightly lower than the inactive bottom surface of the semiconductor device 100′, the portions 22′ of the lead fingers 18′ extending to the ends 106′ of the semiconductor device 100′, and lead finger portions ~~24′ which~~ 24′, which extend under the semiconductor device 100′, which help support the semiconductor device 100′, and terminate at ends 26′ outside the semiconductor device 100′ substantially adjacent a longer peripheral side 104′ of the semiconductor device 100′.

Please replace paragraph number **[0030]** with the following rewritten paragraph:

[0030] The lead frame 10′ of the present invention further includes die paddle 28′ formed by die paddle members 30′ in any desired geometric shape or as a solid, one piece member which are, in turn, connected to die paddle supports 32′, each of which contain downsets 34′ ~~therein~~ therein, so that the die paddle 28′ is substantially located in a horizontal plane below the inactive bottom surface of the semiconductor device 100′. The die paddle supports 32′ each further include ends 36′ ~~thereon~~ thereon, which terminate outside the semiconductor device 100′ substantially adjacent a longer peripheral side 104′ of the semiconductor device 100′.

Please replace paragraph number **[0033]** with the following rewritten paragraph:

[0033] As illustrated, a piece of suitable tape 40′, such as Kapton tape, is adhesively secured, using any suitable thermo- setting adhesive, to the lead finger portions 24′ of the first plurality of lead fingers 18′, the die paddle members 30′, and die paddle supports 32′. Preferably, a silver filled epoxy paste adhesive material is used to adhesively attach the semiconductor device 100′ to the tape 40′.

Please replace paragraph number **[0034]** with the following rewritten paragraph:

[0034] The second plurality of lead fingers 18′ may be used to support the semiconductor device 100′ in the package 200′ and may be used to conduct heat away from the semiconductor device 100′ during operation. In this manner, greater flexibility is created in the design of the circuitry of the semiconductor device 100′ and the location of the bond pads 102′ thereon. Additionally, since the lead frame 10′ of the present invention has the location of the first plurality of lead fingers 12′ adjacent the longer peripheral sides 104′ of the semiconductor device 100′ in substantially the same horizontal plane as the active surface 108′ of the semiconductor device 100′ while the second plurality of lead fingers 18′ is located in substantially the same horizontal plane as the die paddle members 30′ supporting the semiconductor device 100′, the assembly of the semiconductor device 100′ and lead frame 10′ of the present invention may be wire bonded in conventional wire bonding equipment and encapsulated in conventional die molding equipment without substantial modification thereof. In this manner, the present invention of the lead frame 10′ and semiconductor device 100′ saves the expenditure of capital investment in new wire bonding and die molding equipment.

Please replace paragraph number **[0041]** with the following rewritten paragraph:

[0041] As illustrated, a piece of suitable tape 40″, such as Kapton tape, is adhesively secured, using any suitable thermo- setting adhesive, to the lead finger portions 24″ of the first plurality of lead fingers 18″, the die paddle members 30″, and die paddle supports 32″.

Preferably, a silver filled epoxy paste adhesive material is used to adhesively attach the semiconductor device 100″ to the tape 40″.

Please replace paragraph number **[0042]** with the following rewritten paragraph:

[0042] Also, bond pads 102″ are located on the ends 106″ of semiconductor device 100″ and interconnected with the second plurality of lead fingers 18″ or the die paddle supports 32″, if desired. In this manner, greater flexibility is created in the design of the circuitry of the semiconductor device 100″ and the location of the bond pads 102″ thereon. Additionally, since the lead frame 10″ of the present invention has the location of the first plurality of lead fingers 12″ adjacent the longer peripheral sides 104″ of the semiconductor device 100″ in substantially the same horizontal plane as the active surface 108″ of the semiconductor device 100″ while the second plurality of lead fingers 18″ is located in substantially the same horizontal plane as the die paddle members 30″ supporting the semiconductor device 100″, the assembly of the semiconductor device 100″ and lead frame 10″ of the present invention may be wire bonded in conventional wire bonding equipment and encapsulated in conventional die molding equipment without substantial modification thereof. In this manner, the present invention of the lead frame 10″ and semiconductor device 100″ saves the expenditure of capital investment in new wire bonding and die molding equipment.

Please replace paragraph number **[0043]** with the following rewritten paragraph:

[0043] As is readily apparent from the foregoing, the semiconductor assembly of the present ~~invention~~ invention, including a semiconductor device and lead frame having a portion of the lead fingers supporting the semiconductor ~~device~~ device, offers the advantages of having a portion of the lead fingers supporting the semiconductor device thereby allowing a smaller die paddle to be used and a less substantial die paddle to be required, a wide variety of sizes of semiconductor devices may be used with the lead frame, a wide variety of bond pad layouts may be used on the semiconductor devices with the same lead frame, conventional wire bonding equipment may be used to form the connections between the bond pads on the semiconductor

device and the lead frame, conventional transfer molding equipment may be used to encapsulate the assembly, and a higher lead finger density may be used in the same available area depending upon lead frame and semiconductor device design.

Please replace paragraph number **[0044]** with the following rewritten paragraph:

[0044] It is contemplated that changes, additions, modifications and deletions may be made to the semiconductor assembly of the present invention which fall within the scope of the claimed invention. For instance, although the semiconductor device of the present invention is illustrated with longer peripheral sides and opposed ends, the semiconductor device may be substantially square in ~~configuration~~ configuration, thereby having opposed peripheral sides and opposed ends of substantially the same length. The lead frame may be formed with any number of lead fingers as space allows. Any number of lead fingers may be used to support the semiconductor device in addition to/or without a die paddle support of the semiconductor device. The ends of the lead fingers extending along the peripheral sides of the semiconductor device may extend past the ends of adjacent lead fingers. The lead fingers extending below the semiconductor device may be spaced any desired distance below the bottom inactive surface of the semiconductor device.

IN THE CLAIMS:

Claims 1 through 19 are cancelled herein. Claims 20, 23, 24, and 28 through 31 have been amended herein. All of the pending claims are presented below. This listing of claims will replace all prior versions and listings of claims in the application. Please enter these claims as amended.

Listing of Claims:

1.-19. (Cancelled)

20. (Currently amended) A manufacturing method for a lead frame for a semiconductor assembly having a semiconductor device having two opposed peripheral sides, two opposed ends, an active surface in a first horizontal plane, a bottom inactive surface in a second horizontal plane, and a plurality of bond pads located on the active surface of the semiconductor device, a first portion of the plurality of bond pads located adjacent one of the two opposed peripheral sides and a second portion of the plurality of bond pads located adjacent another of the two opposed peripheral sides, said method comprising:

forming a first plurality of lead fingers extending substantially in the first horizontal plane of the active surface of the semiconductor device, each lead finger of the first plurality of lead fingers terminating in an end located adjacent a peripheral side of the two opposed peripheral sides of the semiconductor device;

forming a second plurality of lead fingers having portions thereof extending below the bottom inactive surface of the semiconductor device and having portions thereof extending in the first horizontal plane of said active surface of said semiconductor device, said second plurality of lead fingers having portions extending substantially inwardly and extending downwardly from said first horizontal plane of the active surface ~~a the~~ of the semiconductor device placing portions of said lead fingers in a second substantially horizontal plane for providing support surfaces for portions of said inactive surface of

said semiconductor device, each lead finger of the second plurality of lead fingers having a portion thereof extending adjacent an end of the two opposed ends of the semiconductor device and terminating in an end located ~~adjacent a~~ adjacent the peripheral side of the two opposed peripheral sides of the semiconductor device, at least one lead finger of the second plurality of lead fingers including a section extending substantially in the first horizontal plane; and

forming a die paddle for attaching portions of said inactive surface of said semiconductor device.

21. (Original) The method of claim 20, wherein the ends of the first plurality of lead fingers extend past the ends of adjacent lead fingers of the second plurality of lead fingers.

22. (Original) The method of claim 20, wherein the ends of the second plurality of lead fingers extend past the ends of adjacent lead fingers of the first plurality of lead fingers.

23. (Currently amended) The method of claim 20, further including ~~the step of~~: placing tape on the second plurality of lead fingers.

24. (Currently amended) The method of claim 20, further including ~~the step of~~: placing tape between the die paddle and the bottom inactive surface of the semiconductor device.

25. (Original) The method of claim 20, further including:

placing tape between the die paddle and the second plurality of lead fingers and the bottom inactive surface of the semiconductor device.

26. (Original) The method of claim 24, further comprising:

adhesively attaching the second plurality of lead fingers to the tape.

27. (Original) The method of claim 26, further comprising:
adhesively attaching the second plurality of lead fingers to the tape using thermosetting adhesive.

28. (Currently amended) The method of claim 20, wherein the die paddle includes at least one portion thereon extending ~~beyond a~~ beyond the peripheral side of the two opposed peripheral sides and at least another portion thereof extending beyond ~~an end~~ the end of the two opposed ends of the semiconductor device.

29. (Currently amended) The method of claim 20, wherein ~~the at least one~~ each lead finger of the second plurality of lead fingers includes an offset therein.

30. (Currently amended) The method of claim 20, wherein the second plurality of lead fingers includes:
at least one lead finger having a portion thereof extending adjacent a portion of a lead finger of the first plurality of lead fingers, a portion thereof extending substantially adjacent the end of the two opposed ends of the semiconductor device, a portion extending substantially opposed ~~to an~~ to the end of the two opposed ends of the semiconductor device, and having a portion extending ~~beyond a~~ beyond the peripheral side of the two opposed peripheral sides of the semiconductor device.

31. (Currently amended) The method of claim 20, wherein the second plurality of lead fingers includes:

at least one lead finger having a portion thereof extending adjacent a portion of a lead finger of the first plurality of lead fingers, a portion thereof extending substantially adjacent ~~an end~~ the end of the two opposed ends of the semiconductor device, a portion extending substantially opposed ~~to an~~ to the end of the opposed ends of the semiconductor device and extending adjacent a portion of the die paddle, and having a portion extending ~~beyond a~~ beyond the peripheral side of the two opposed peripheral sides of the semiconductor device.